



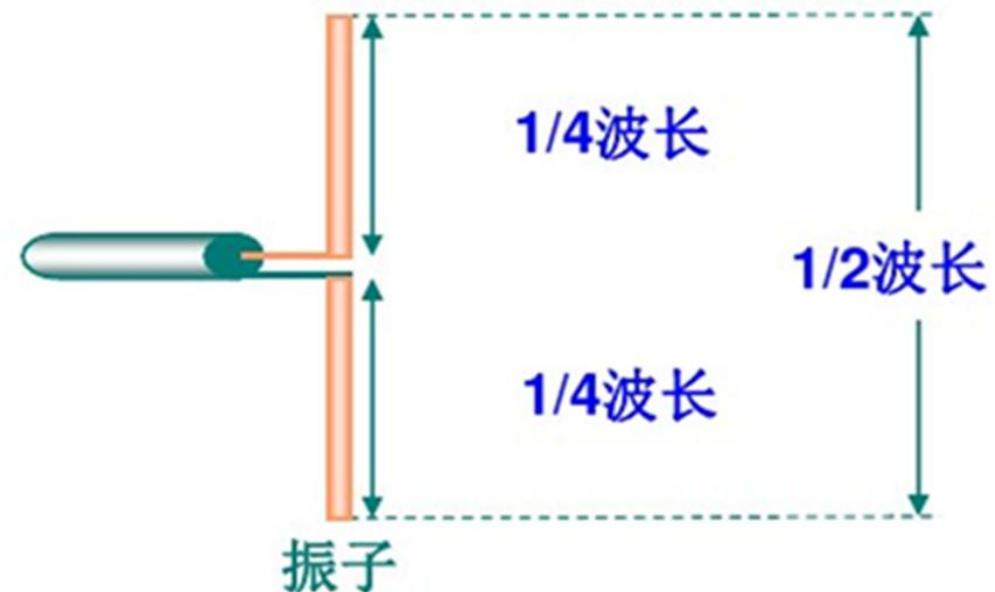
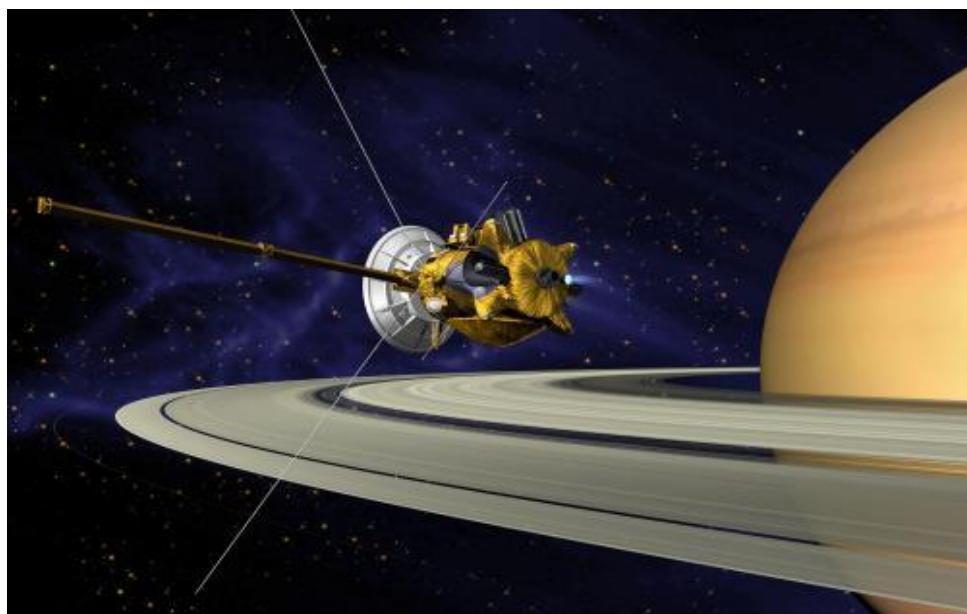
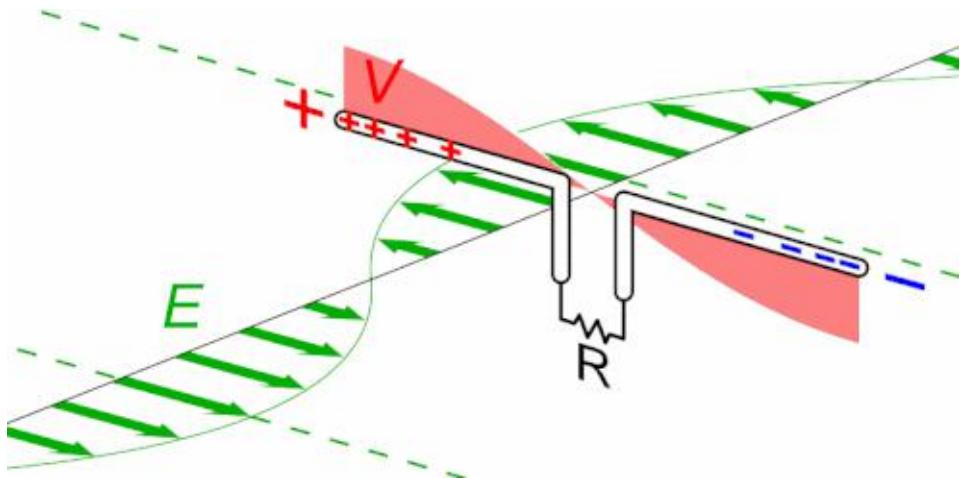
Southern University  
of Science and  
Technology

# Data acquisition and processing (counting)

Xian-Ming Zheng

2020/10/28

# Antenna theory and selection

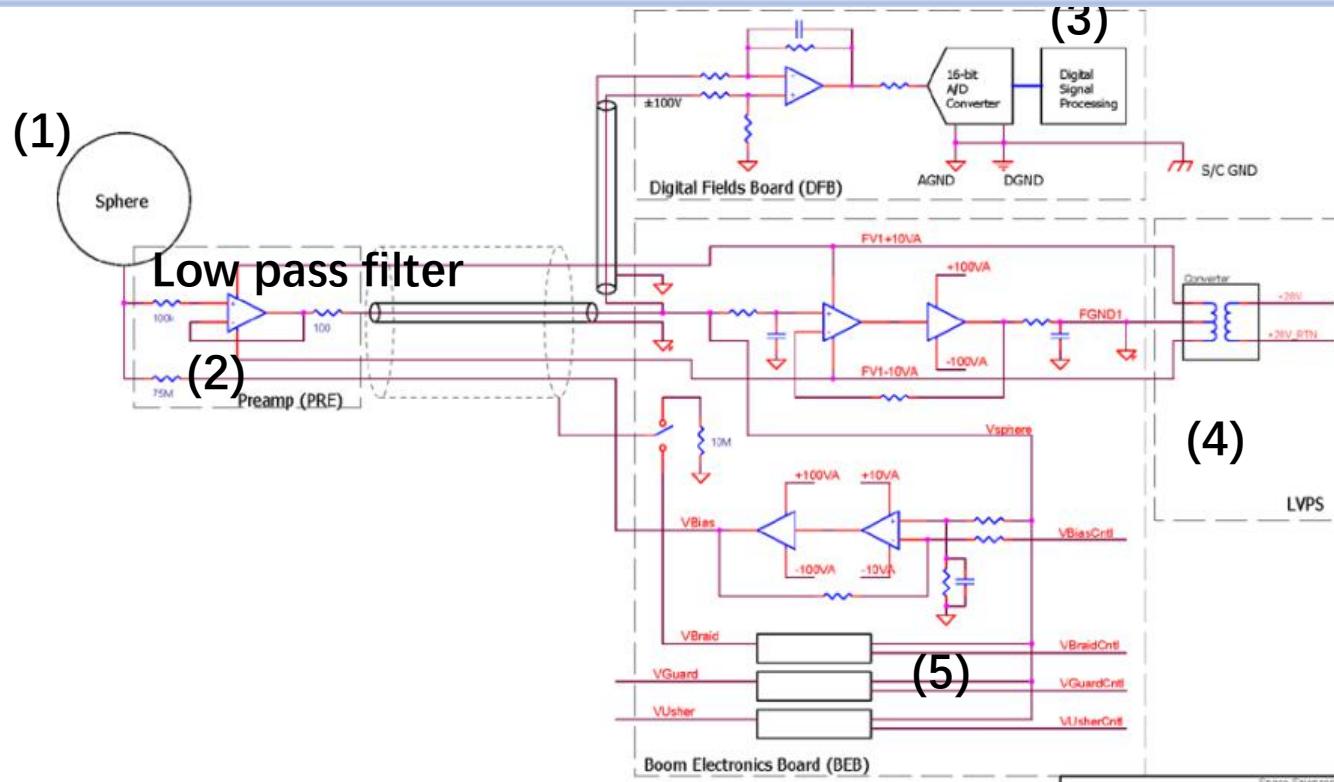


$$\text{Length of antenna} = (1/2)\lambda = 1\text{m}$$

$$\lambda = c/f$$

$$\lambda = 2\text{m} \quad f = 150\text{MHz}$$

# Structure of EFI

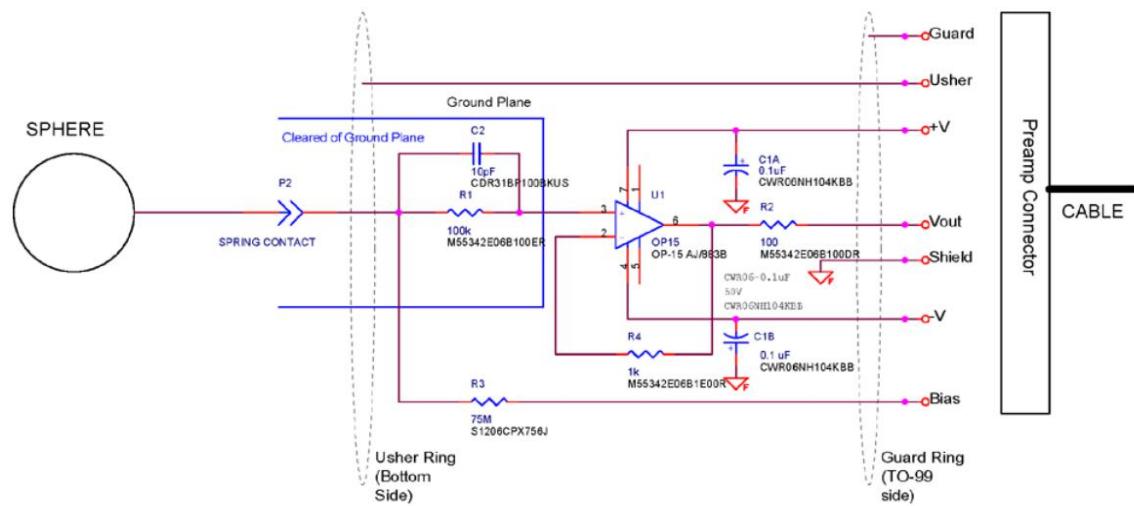


**Fig. 5** Functional Block Diagram of THEMIS EFI, showing preamp, BEB, floating supply, and DFB connections for a single sensor

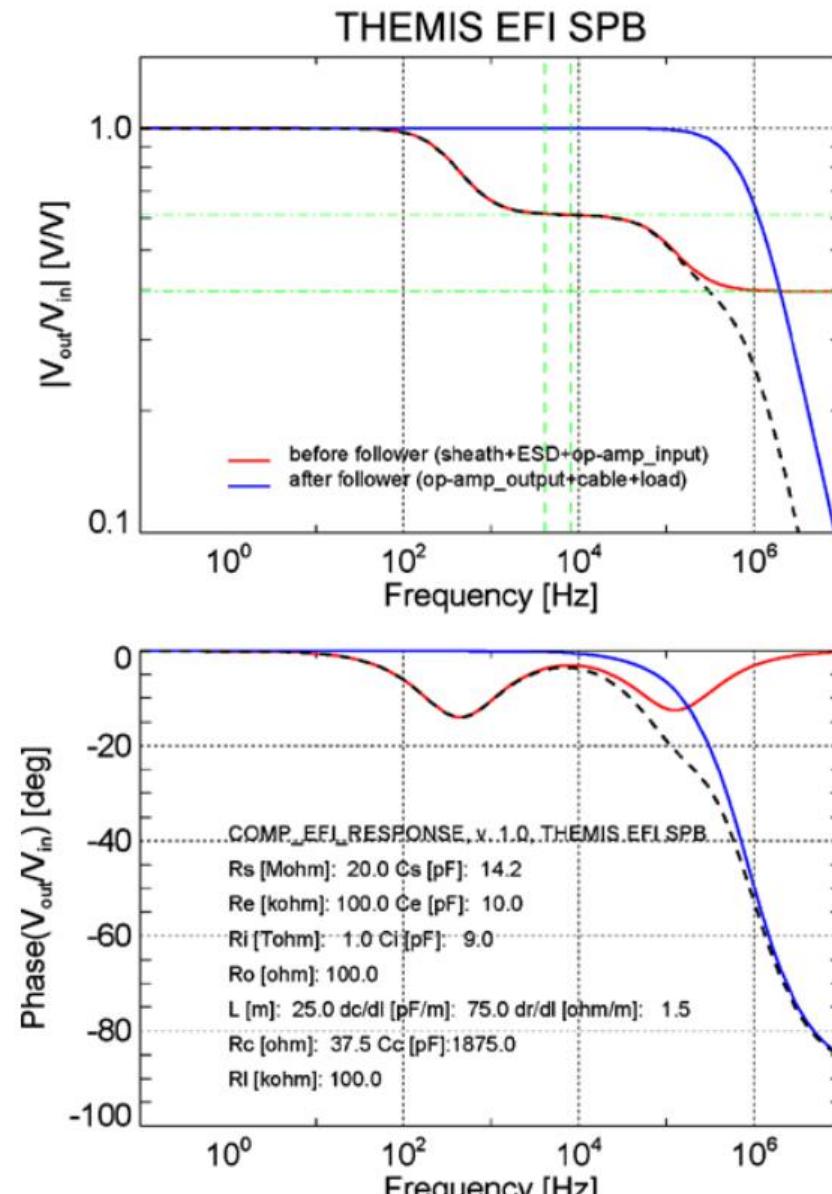
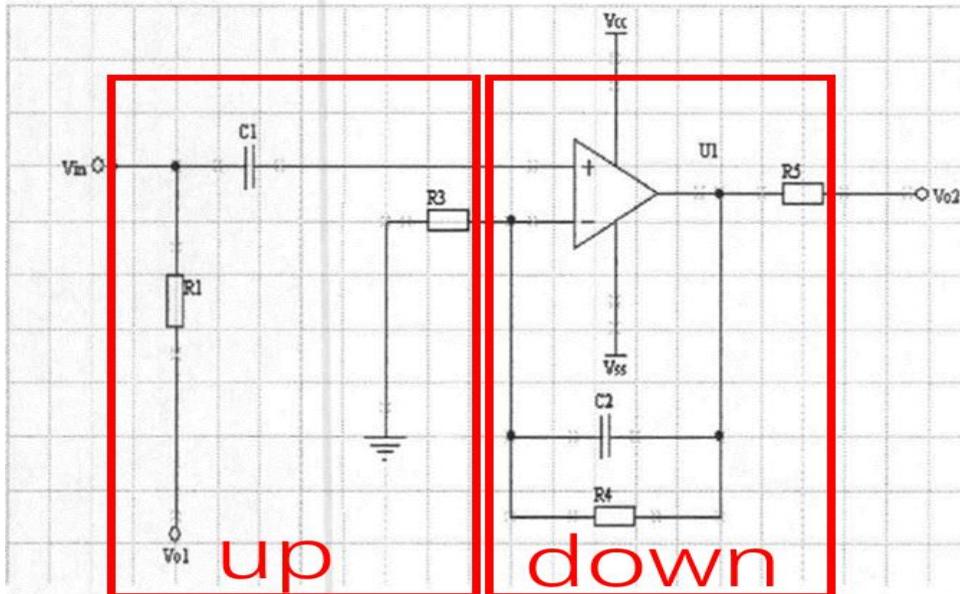
[J.W. Bonnell , et al ,2008 ]

in the block diagram, running from the sensor, through the preamp and cable system, to the Digital Fields Board (DFB), Boom Electronics Board (BEB), and Low-Voltage Power Supply (LVPS) located in the central Instrument Data Processing Unit (IDPU).

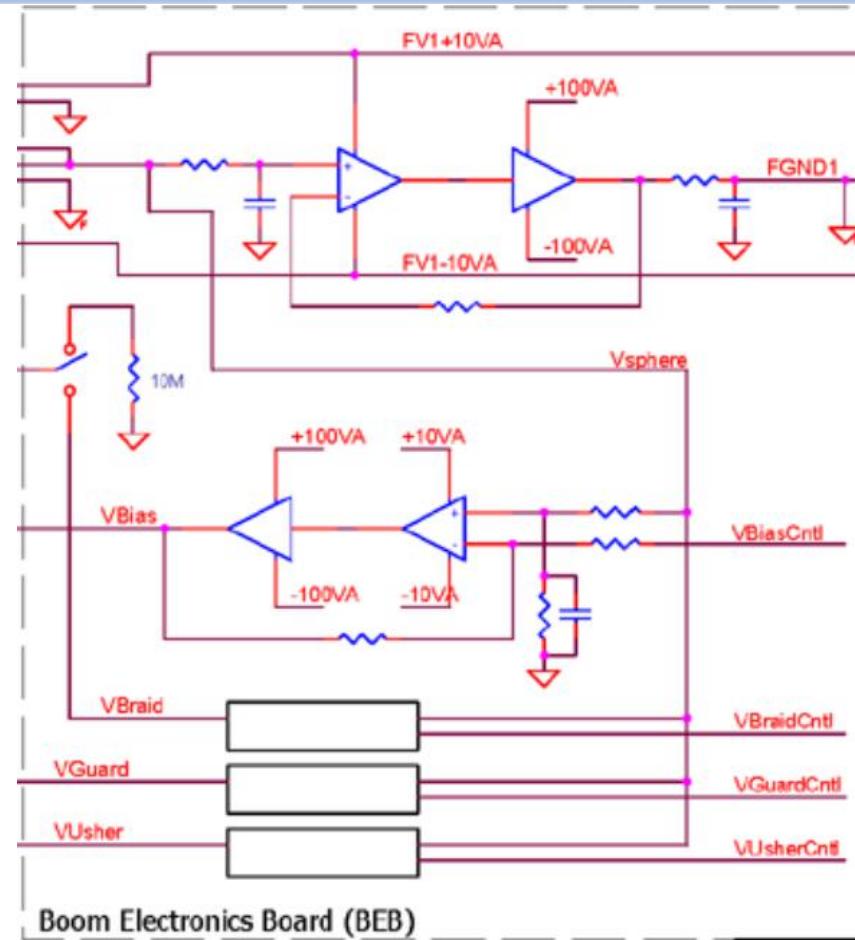
# Structure of EFI



**Fig. 6** Schematic diagram of THEMIS-EFI preamp



# Structure of EFI



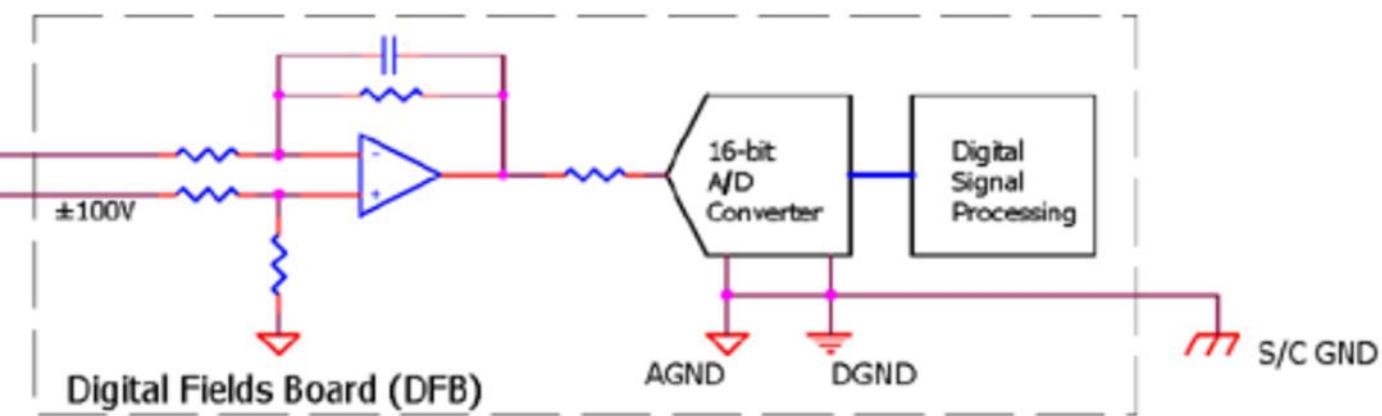
D braid 编织、镶边

As is shown in Fig. 5, the BEB is responsible for generating and controlling the floating grounds (FGND), current- (BIAS) and voltage- (USHER, GUARD, DBRAID) bias signals for each of the six EFI sensors, as well as DBRAID reference selection. Current and voltage

# Structure of EFI

**Table 3** Data products available from EFI

Data product	Range (not adjusted for frequency-dependent gain)	Bits	Resolution	Available sampling rates
V1,...,V6	$\pm 105$ V ( $\pm 100$ V supply limited)	16	3.2 mV/ADC	2-8192 samp/s
EDC12 (49.6-m)	$\pm 300$ mV/m	16	(9.2 $\mu$ V/m)/ADC	2-8192 samp/s (16384 samp/s for AC)
EAC12 (49.6-m)	$\pm 51$ mV/m		(1.6 $\mu$ V/m)/ADC	
EDC34 (40.4-m)	$\pm 370$ mV/m	16	(11 $\mu$ V/m)/ADC	2-8192 samp/s (16384 samp/s for AC)
EAC34 (40.4-m)	$\pm 63$ mV/m		(1.9 $\mu$ V/m)/ADC	
EDC56 (6.2-m)	$\pm 2.7$ V/m	16	(81 $\mu$ V/m)/ADC	2-8192 samp/s (16384 samp/s for AC)
EAC56 (6.2-m)	$\pm 450$ mV/m		(14 $\mu$ V/m)/ADC	
HF	4 $\mu$ V/m to 12 mV/m	8	0.01 decade of amplitude/ADC	2-8192 samp/s
Spin fit $E_{xy}$	Same as EDC12 or EDC34, depending upon source setting	16-bit floating point	Same as EDC12 or EDC34, depending upon source setting. ≈1 deg. In angle	1 vector/spin (typ. 3-s period)
Spin avg $E_z$	Same as EDC56	16-bit floating point	Same as EDC56	1/spin (typ. 3-s period)



The HF channel is a special-purpose, broadband filter channel covering the auroral kilometric radiation emission band (100–400 kHz) with peak response at 130 kHz, and half-

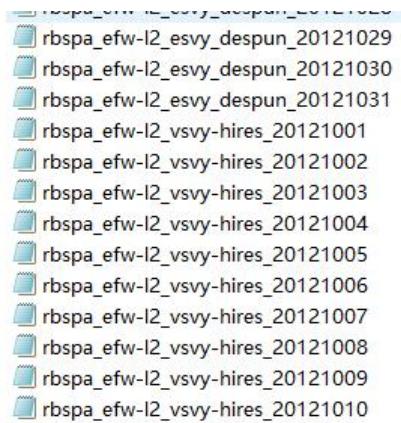
128-sample/s data from either the DC-coupled E12 or E34 channel

DC to 4 kHz (8 kHz for AC-coupled  $E$ -field products), and that power present at higher frequencies is integrated into the single HF channel described above. This feature of the design was driven by the maximum frequencies required to achieve the science requirements, and the tight power and telemetry resources available for the THEMIS mission.

# Data acquisition unit

```
>> irf_cdf_read
1. rbsp-b_density_emfisis-14_20121101_v1.5.15.cdf
2. rbsp-b_density_emfisis-14_20130317_v1.5.15.cdf
3. rbsp-b_magnetometer_lsec-gse_emfisis-13_20121101_v1.3.3.cdf
4. rbsp-b_magnetometer_lsec-gse_emfisis-13_20130317_v1.3.3.cdf
5. rbsp-b_magnetometer_hires-gse_emfisis-13_20121101_v1.6.1.cdf
6. rbsp-b_magnetometer_hires-gse_emfisis-13_20130317_v1.6.2.cdf
7. rbspb_efw-12_e-spinfit-mgse_20130317_v02.cdf
8. rbspb_efw-12_esvy_despun_20121101_v02.cdf
9. rbspb_efw-12_esvy_despun_20130317_v02.cdf
10. rbspb_efw-12_vsvy-hires_20121101_v01.cdf
11. rbspb_efw-12_vsvy-hires_20130317_v01.cdf
12. rbspb_efw-13_20121101_v01.cdf
13. rbspb_efw-13_20130317_v02.cdf
14. rbspb_12_psbr-rps_20130317_v1.2.1.cdf
Choose cdf file
Cdf_file? [1]>8
```

86339x4 double											
	1	2	3	4	5	6	7	8	9	10	11
1	0.2690	-229.9670	-14.3735	280.8170							
2	1.2690	-230.2570	-14.4240	281.4370							
3	2.2690	-230.2720	-15.1854	281.6860							
4	3.2690	-229.9180	-15.5969	281.3590							
5	4.2690	-229.7090	-15.4837	280.6780							
6	5.2690	-229.7840	-14.7709	280.4820							
7	6.2690	-230.0740	-14.2844	280.9560							
8	7.2690	-230.3560	-14.5055	281.4190							
9	8.2690	-230.3520	-14.9166	281.5160							
10	9.2690	-230.2550	-15.0950	281.1920							
11	10.2690	-230.3710	-14.6999	281.1510							
12	11.2690	-230.6670	-14.4888	281.6080							
13	12.2690	-230.9240	-14.8199	282.2380							
14	13.2690	-230.8730	-15.6579	282.3290							
15	14.2690	-230.6410	-16.0213	281.7720							
16	15.2690	-230.3210	-15.7868	281.3190							
17	16.2690	-230.4800	-14.9297	281.3570							
18	17.2690	-230.7750	-14.7005	281.9290							
19	18.2690	-230.9490	-14.9449	282.3760							
20	19.2690	-231.1170	-15.4472	282.1500							
21	20.2690	-231.0890	-15.2934	281.8150							
22	21.2690	-231.2670	-14.8124	281.8500							
23	22.2690	-231.5200	-14.5985	282.4160							
24	23.2690	-231.6440	-14.9835	282.9560							
25	24.2690	-231.4960	-15.6868	282.7670							
26	25.2690	-231.2900	-15.8571	282.0620							



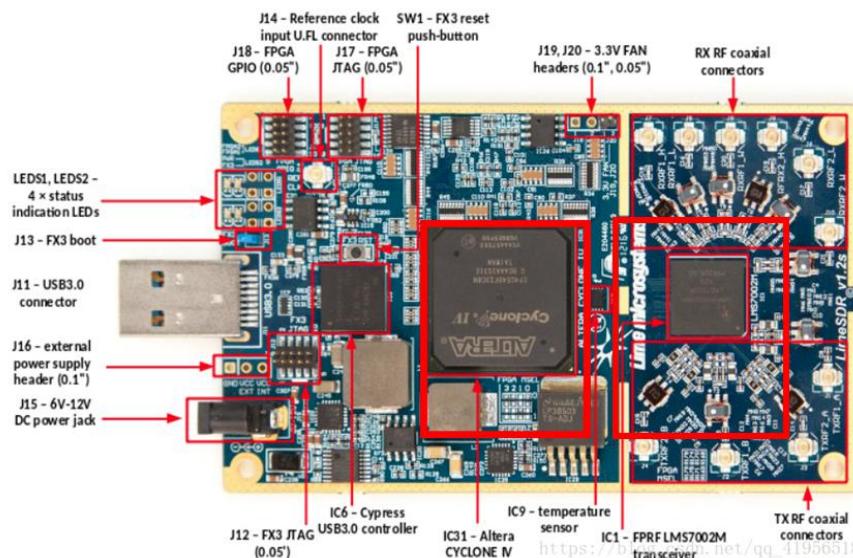
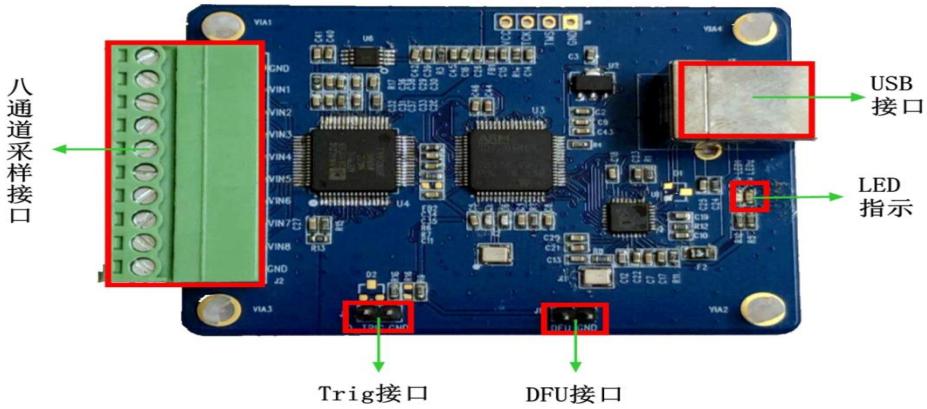
2020/9/27 8:52	CDF 文件	37,455 KB
2020/9/27 8:55	CDF 文件	37,610 KB
2020/9/27 8:53	CDF 文件	37,327 KB
2020/9/27 9:03	CDF 文件	22,077 KB
2020/9/27 9:01	CDF 文件	17,176 KB
2020/9/27 9:03	CDF 文件	20,674 KB
2020/9/27 9:03	CDF 文件	20,701 KB
2020/9/27 9:03	CDF 文件	20,034 KB
2020/9/27 8:54	CDF 文件	21,857 KB
2020/9/27 8:59	CDF 文件	20,734 KB
2020/9/27 8:59	CDF 文件	27,928 KB
2020/9/27 8:58	CDF 文件	26,599 KB
2020/9/27 8:54	CDF 文件	21,737 KB

Clock

# Data acquisition unit

How to split  
7> 16 位、200 kSPS ADC (本设备最大支持 100K)。

端口说明见下表



端子号	功能说明	端子号	功能说明
GND	电源地	GND	电源地
AN1	采样通道一	AN5	采样通道五
AN2	采样通道二	AN6	采样通道六
AN3	采样通道三	AN7	采样通道七
AN4	采样通道四	AN8	采样通道八

- 内存: 256 MBytes DDR2 SDRAM
- USB 3.0控制器: 赛普拉斯USB 3.0 CYUSB3014-BZXC
- 振荡器: Rakon RPT7050A @ 30.72MHz
- 连续频率范围: 100 kHz - 3.8 GHz
- 带宽: 61.44 MHz
- RF连接: 12个U.FL连接器 (6个RX, 4个TX, 2个CLK I / O)
- 功率输出 (CW) : 高达10 dBm
- 多路复用: 2x2 MIMO

# Data acquisition unit

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ADC Settings 参数说明如下:

**TrigSize:** 采样板 buff 大小设置，达到这个设置后上报采样数据，必须是 16 的整数倍，没有到这个设置，只有停止采样后才上报采样数据,最大值 3072, Buff 越小上报的频率越快。

**MaxCycles:** 最大采样轮数，启动采样后，达到这个设置后，自动停止采样。设置为 0 时，一直采样不停止。

**A-B delay:** 前四个采样通道和后四个采样通道之间的延时，默认没有延时，八通道同时采样。

**Period:** 采样周期设置，时间单位有 us 和 ms，最小采样周期 10us，即 100KHz，最大采样周期 1000ms，即 1S。

**GPIO Type:** GPIO 触发条件，可以设置为上升沿触发，下降沿触发，或者两者都触发。

**Trig Mode:** 采样触发条件，可以设置为周期性触发，GPIO 触发或者两者混合触发。

**Range:** 采样输入范围选择，同 AD7606 range 选择说明。

**OS:** 过采样设置，同 AD7606 OS 设置说明。

**Refsel:** 参考电压选择，默认是外部参考，选择采样板上高精度参考芯片 ADR421。

改变设置后，点击 Set Config 按钮才可以使设置生效。

# Data acquisition unit

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## 触发事件说明

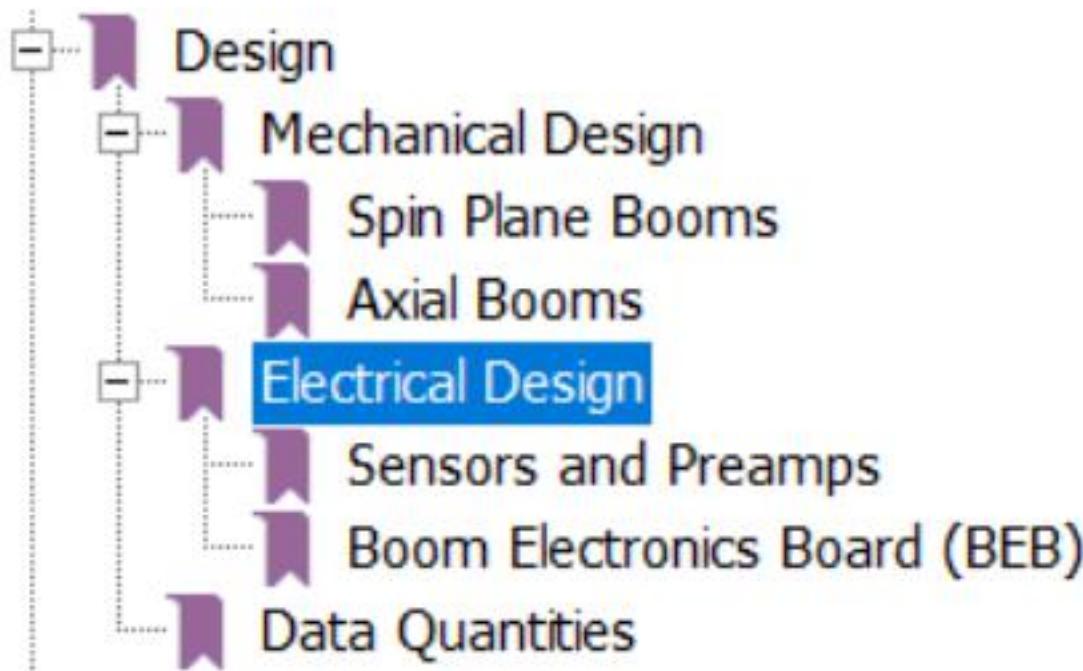
- 1> 周期性触发事件，当 Trig mode 设置为 Period 时，产生周期性触发事件，每隔一个 period 周期执行一轮采样。
- 2> GPIO 触发事件，当 Trig mode 设置为 GPIO 时，产生 GPIO 触发事件。每个 GPIO 的上升沿或者下降沿执行一轮采样。
- 3> 混合触发事件，当 Trig mode 设置为 both 时，产生混合触发事件。产生 GPIO 触发事件后才进入 Period 采样。也就是说 GPIO 触发是启动条件，period 是执行采样的间隔。

## 五、自主开发

用户可以自己开发上位机软件，有关库函数调用请参考库函数使用说明。默认的库文件是 window 32 bit 库，只供 VC 调用。如果需要 64bit 和 VB.net 的库或 linux 的库，请联系技术支持人员。

# Questions

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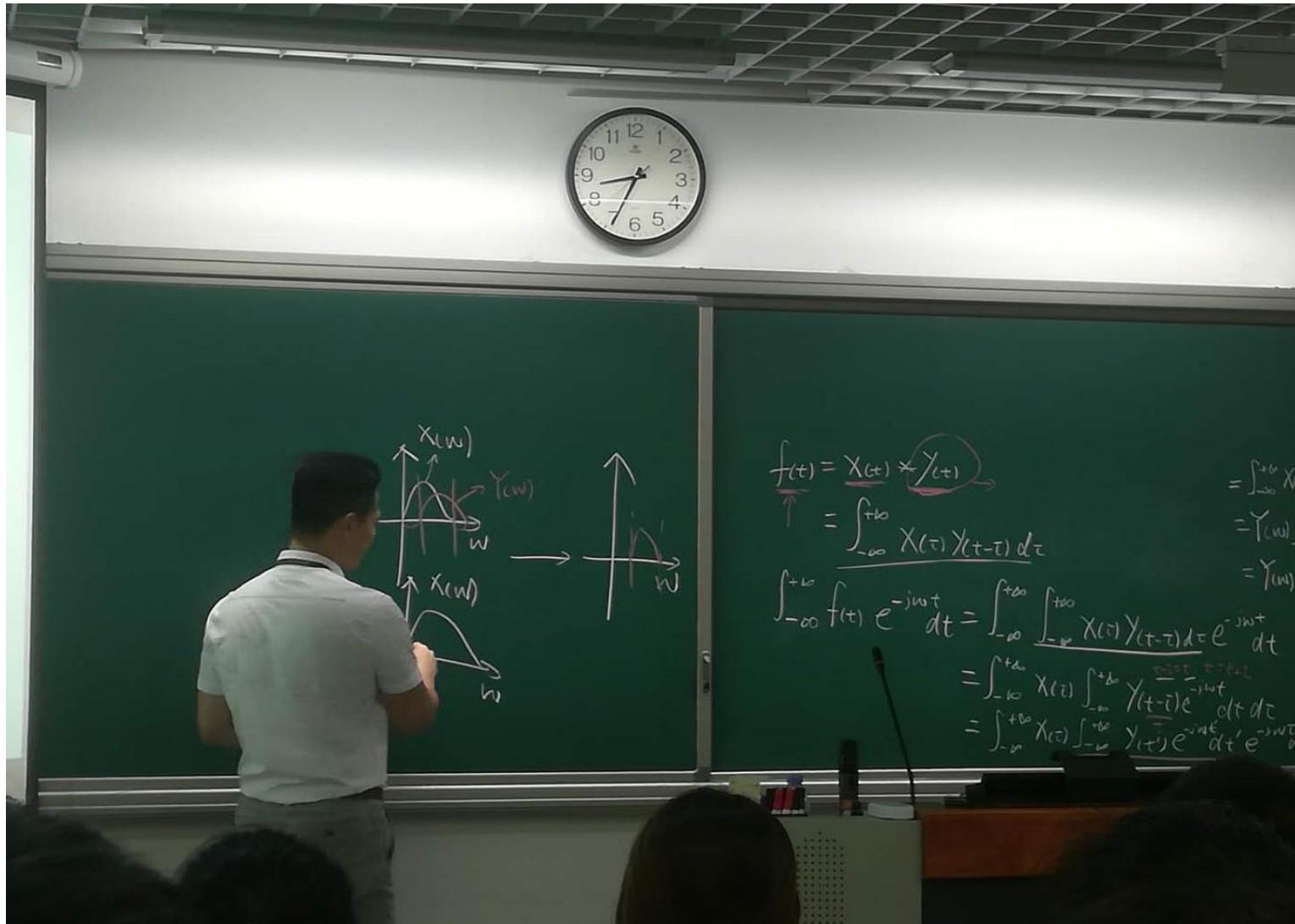
proton inertial length is  $\lambda_p = \sqrt{m_p/n_0\mu_0 e^2}$

$$\lambda_D$$

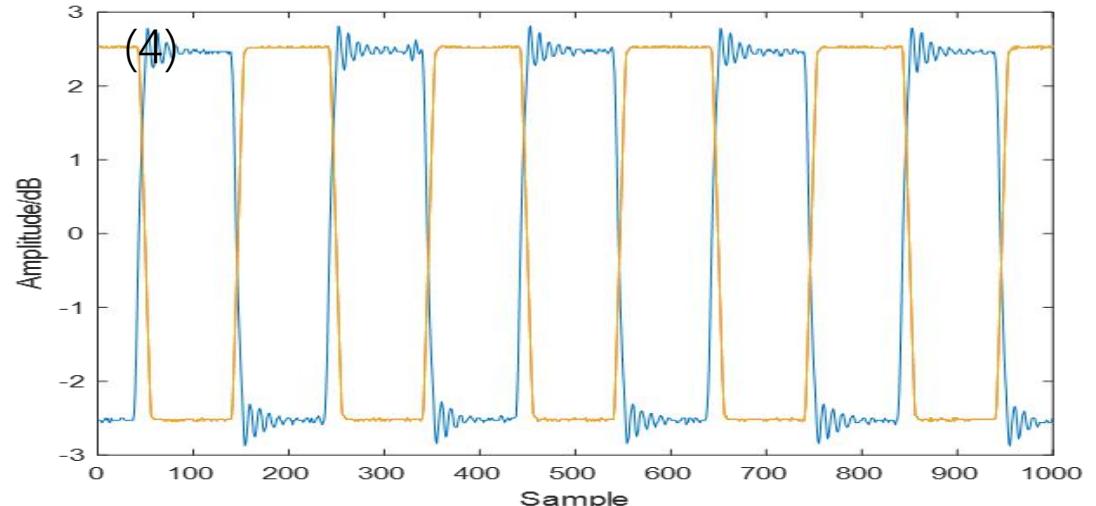
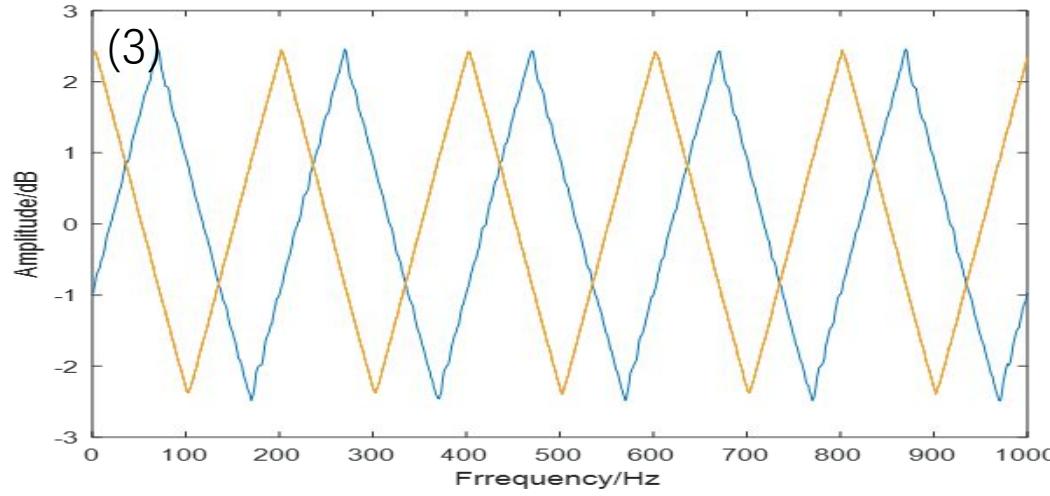
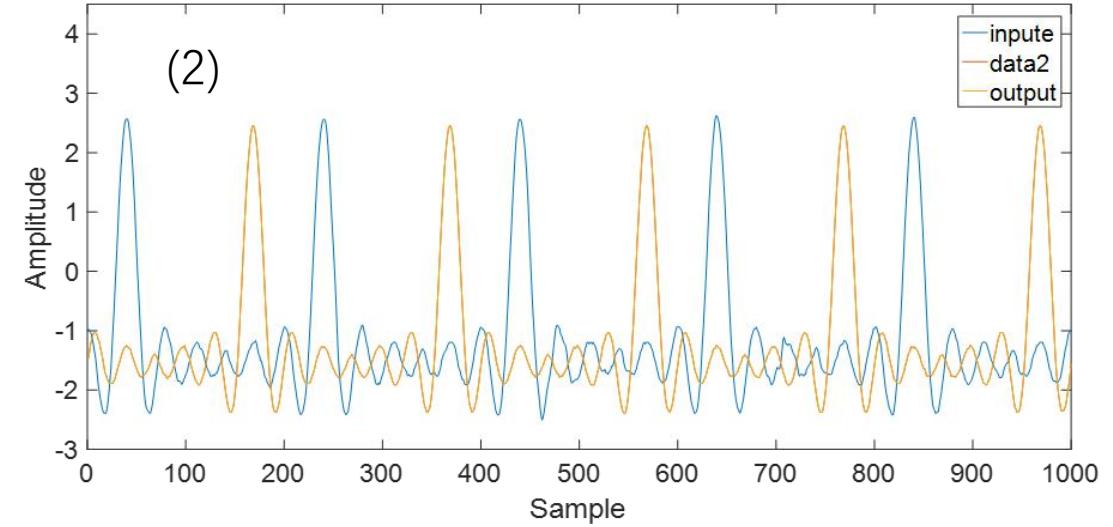
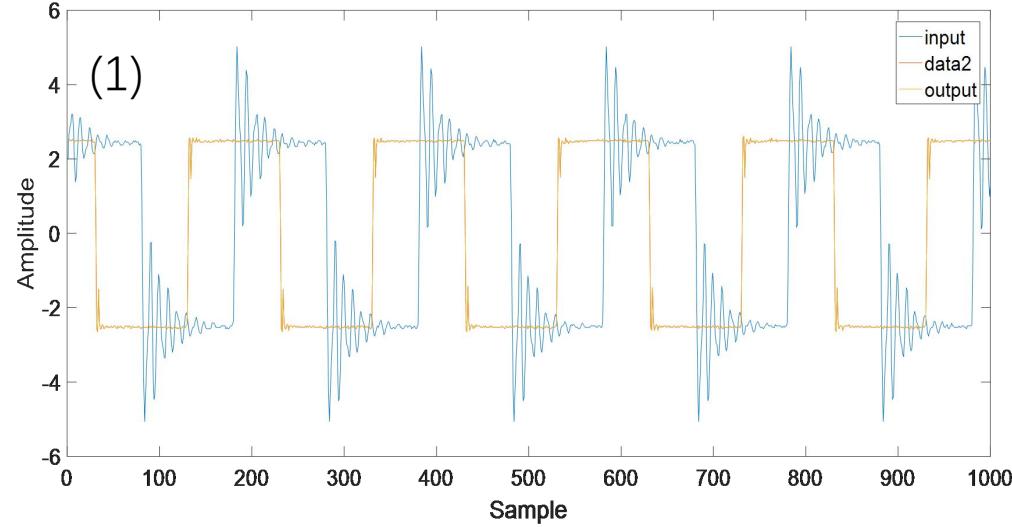
It is the shell O<sup>+</sup> population which causes the positive slope  $\frac{\partial f}{\partial v} > 0$

where  $v_{A,O^+} = B_0/\sqrt{\mu_0 n_0 m_{O^+}}$  is the oxygen Alfvén speed. It is the shell O<sup>+</sup> population which causes the positive slope  $\partial f/\partial v_\perp > 0$  and provides the free energy to drive the O<sup>+</sup> Bernstein waves unstable. Finally, the

# Questions



# Result



# Result

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